

Few points in this book call for adverse criticism. In determining the motion of the frame consisting of tangent, normal and binormal at any point of a curve, it would be clearer to introduce the curvature and torsion into the general formulæ for moving axes as measures of small rotations, and it would be more convenient to make a positive torsion correspond to a positive rotation (in this connection the English reader may be warned that the term "rechts-gewunden" is applied to what we should call a "left-handed" screw). It is surprising that no general method is given for expanding the coordinates in powers of the arc; the employment of these expansions very much simplifies the investigation of osculating helices and of the osculating cone, and can hardly be objected to on the ground of being a "Kunstgriff."

The book is written in a very pleasing style, with that light and clear touch which we are accustomed to associate with French writers, and except in one or two instances the analysis is very judiciously handled. For soundness it leaves nothing to be desired and its incompleteness is only an incentive to deeper research into the subject. Specially commendable are the careful explanations of points which are usually slurred over. A distinct feature is the introduction of imaginary quantities at an early stage and the discussion of exceptional cases that arise in connection with minimal lines and curves. The whole book is pervaded by the ideas which are associated with the name of the author's great master, Sophus Lie.

The type is clear and good, misprints seldom occur, and the figures are excellent. The practice of giving two or three orthogonal projections instead of one figure in perspective is much to be commended as a means of conveying exact information and of training the student to build up a mental conception of a figure in three dimensions.

The second volume, which is promised in the course of next year, will be awaited with the greatest interest.

R. W. H. T. H.

OUR BOOK SHELF.

Les Phénomènes électriques et leurs Applications. By H. Vivarez. Pp. vi + 574. (Paris: Carré and Naud, 1901.) Price Fr. 15.

M. VIVAREZ'S book covers almost the whole field of modern electrical practice in a manner which is neither too technical nor too popular. The daily increasing applications of electricity in the industries and arts render such a book valuable in two ways. In the first place, it should appeal to the ordinary engineer, manufacturer or man of science who finds himself obliged to make use of electricity in some way or other, and who can turn to its pages for general information on the subject. Secondly, the electrical engineer is generally obliged nowadays to become a specialist in some particular branch of his profession, and is liable, in consequence, to get out of touch with other branches with which it is desirable he should have a general, if not a detailed, acquaintance. Such he can obtain from a book of this kind. M. Vivarez has set out with the object of supplying the wants of these persons, and also, doubtless, the want of the intelligent amateur who is anxious to keep pace with modern industrial progress, and he has, we think, succeeded admirably in his endeavour. He has produced a book which is thoroughly readable and interesting, and is not at all overlaid with calculation or

technical detail. Perhaps in some cases he has shown rather a tendency to skip over the less interesting parts at a sacrifice of clearness, as, for example, in the section on units. This may not be of much importance to the electrician who will have obtained his fundamental conceptions elsewhere, but it is a great disadvantage to the non-electrical reader, who can never properly understand the subject unless his knowledge of the groundwork be sound—a truth he is himself too prone to ignore.

In a book of this kind a great deal depends on the proper proportioning of the space allotted to the various subjects considered. On the whole, M. Vivarez has divided his space very fairly, though he has given rather an undue preponderance to the more modern "engineering" developments. More space should, we think, have been devoted to telegraphy, which is at once the oldest and the most important application of electricity; electrochemistry and metallurgy are also treated somewhat too briefly. We looked in vain, also, for any description of vacuum tubes; their omission is unfortunate, seeing of what value they have become to mankind since Röntgen's discovery. The X-ray may have passed rather from the hands of the electrician to those of the surgeon, but it remains, all the same, an important "phénomène électrique."

The most interesting portions of the book, to our mind, are the historical parts. M. Vivarez has given a brief historical account of all the important developments, and has carried this to the extent of even giving a short history of the industrial employment of coal. These historical summaries are both interesting and valuable, the more so as this is a side of science too frequently neglected. Is it because the development is so rapid that the history cannot keep pace with it, or, as we are inclined to believe, because of the natural antipathy of the average engineer to anything that tends to be literary? In any case, there can be no doubt that many engineers will be found ignorant, not only of the works, but even of the names of the men who have made their profession, and for this reason we would recommend the book before us to the student of electrical engineering; it will show him the importance of the work of the man of science, and may bear useful fruit in inducing him to read original papers.

The Agricultural Changes and Laying Down Land to Grass. By R. H. Elliott, 2nd edition. Pp. xii + 101. (Kelso: J. and J. H. Rutherford, 1901.)

MR. ELLIOTT has for some years been pursuing a system of agriculture on his estate in Roxburgh, the essential feature of which is that he secures a thick turf by the use of heavy seedlings of the stronger grasses and other pasture plants, and after half a dozen years or so humus has accumulated to such an extent that the land may be put through a course of tillage cultivation without the use of any fertiliser but artificial manures. The seed-mixture that he uses is characterised not only by its abundance, but also by the fact that it contains the seeds of such out-of-the-way plants as burnet and chicory. Mr. Elliott is a firm believer in the ameliorative influence of deep roots on the subsoil, and certainly his pastures yield a large amount of food. He claims that the temporary leys secured under his system are much more profitable than "our two great enemies, turnips and cereals," and our national statistics show that many farmers are of the same opinion. The system has, no doubt, answered well in the comparatively cool and humid atmosphere of the Cheviot uplands, but whether it is capable of successful adoption in the drier districts of England is another matter. As Mr. Elliott has not put his system into competition with the ordinary methods of management of temporary grass land, it is impossible to say whether it is an improvement on general practice or not. Be this as it may, it does not

seem that the author has made out a case for the Board of Agriculture taking over his farm and converting it into a national object-lesson. It would be much cheaper, and quite as useful, to have his prescriptions tested on a practical scale in other parts of the country, and this the Board of Agriculture and the agricultural colleges might very well arrange to do.

Friederich Wöhler, Ein Jugendbildniss in Briefen an Hermann von Meyer. Edited by Georg W. A. Kahlbaum. Pp. 97. (Leipzig: J. A. Barth, 1900.) Price M. 2.40.

THESE letters were found amongst the Hermann von Meyer's bequest to the Munich Academy of Science, and Prof. Kahlbaum has done well by making them accessible to a larger circle in their present form.

Although A. W. v. Hofmann, in his charming work, "Zur Erinnerung an Vorangegangene Freunde" (Braunschweig: Vieweg und Sohn, 1888), has given a history of Wöhler's life, these letters to the intimate friend of his youth furnish a most interesting supplement to Hofmann's narrative, and will be particularly appreciated by the surviving pupils and friends who enjoyed the privilege of personal acquaintance with Wöhler, or the still larger number who now or in the future take an interest in the history of the early days of modern chemistry. This publication comprises letters covering but a short period, they are neither remarkable for style nor form, as they were obviously only intended for the person to whom they were addressed; but they are, perhaps, all the more valuable on this account, for they give a characteristic and life-like record. Prof. Kahlbaum, whilst scrupulously preserving the original text of the letters, has taken great pains in collecting additional information respecting the persons and places mentioned, and his copious footnotes afford a most useful framework to the letters, which in themselves give us so vivid a picture of the condition of things under which the ardent and youthful enthusiast pursued, with such eager devotion, his experiments and studies, and thus prepared himself for the high position he so soon attained amongst the leading chemists of his age.

H. M.

Die Flora der Deutschen Schutz-gebiete in der Südsee. Von Prof. Dr. Karl Schumann und Dr. Karl Lauterbach. Pp. xvi + 613, with 23 lithographic plates. Large octavo. (Leipzig: Gebr. Borntraeger, 1901.)

SINCE the acquisition of Kaiser Wilhelmsland and the neighbouring islands, German explorers and botanists have been busy working out the flora of their new possessions; and now, some seventeen years from the date of annexation, all available information is made accessible in the imposing volume under review. The immediate cause of the issue of this Flora is that the series of extensive collections that have recently come to hand necessitated a considerable volume for their adequate description. This, and the fact that the literature on the flora is much scattered, has prompted the authors to expand their undertaking so as to include the results of earlier explorations. The area dealt with includes, besides Kaiser Wilhelmsland (German New Guinea), the adjacent Bismarck Archipelago, the more westerly of the Solomon Islands, the Marshall, Caroline and Marianne Islands. In all over 2200 species are enumerated, and of these 400 are described for the first time, or have become known only from the recent collections which have led to the publication of this Flora. The species are distributed as follows:—Algæ, 222; Fungi and Lichens, 226; Bryophytes, 200; Pteridophytes, 155; Gymnosperms, 12; Monocotyledons, 392; Dicotyledons, 1000. The new forms are all fully described, whilst both for these and for all the plants enumerated, admirably full localities are given. Many of the new forms are of considerable interest, and fourteen new genera are created. There is a new species of *Cycas* occurring in

the Bismarck Gebirge up to a height of 3000 ft., in habit resembling an Australian *Xanthorrhœa*; Guppy's interesting *Sararanga* (Pandanaeae) is recorded with an extended distribution; there is a small Palm, *Dammera*, allied to *Licuala*; whilst among Dicotyledons, *Ficus arbuscula*, a fig-tree 3 to 6 feet high, may be mentioned. The new *Hibiscus papuanus* is spoken of as possessing the most strikingly beautiful flowers in the whole region. The additions to Rubiaceae are considerable, and include *Dolicholobium Gertrudis* with curious dimorphic flowers. A second species of *Bothryocline* (Compositae) considerably extends the distribution of a genus previously restricted to Africa. In *Psychotria myrmecophila*, from the Bismarck Gebirge, we have a new type of ant-plant with curious excavated trifid stipules, which appear to harbour ants in their recesses; its biological relations will require to be worked out on the spot.

The work contains, in addition to a brief introduction by Prof. Schumann, an interesting history of the botanical exploration of the whole region by Dr. Lauterbach, the enlightened director of the New Guinea Company. Included in the volume are twenty-three large plates, which adequately portray the characters of the more important novelties. Certainly the authors are to be congratulated upon their achievement, which is a model of what such a work should be. It will prove a boon to the local officials, colonists and missionaries, and cannot help but stimulate further research.

Fact and Fable in Psychology. By Joseph Jastrow. Pp. xi + 375. (Boston and New York: Houghton, Mifflin and Co., 1900.)

OF the eleven essays here reprinted the first seven are devoted to a common subject, viz. the so-called "occult" side of mental life and its significance for psychology. Prof. Jastrow's attitude towards the whole problem is marked by a luminous common sense which is, unfortunately, rarer even among serious psychologists than it should be. For scientific psychology the real question, as he never tires of pointing out, is not how to explain the marvels of spiritualism and allied arts, but how to account for the existence and wide diffusion of the state of mind which can believe in them. It is for the expert in conjuring tricks to show how the feats of the medium and the miracle-worker are done; the task of the psychologist is to investigate the "Psychology of Deception." Incidentally, however, such papers as Prof. Jastrow's essays on "The Psychology of Spiritualism" and "Hypnotism and its Antecedents," besides throwing light on the mental condition of the deceived, are interesting as showing how more than one famous occultist has executed his deceptions. The latter of the two papers just named brings out clearly and well the enormous difference between the spirit and methods of science and of superstition in dealing with one and the same set of facts. In the essay on "The Problems of Psychical Research" Prof. Jastrow is perhaps on more debatable ground, though his attitude seems to the present reviewer at least the only scientific one. Briefly his position may be summed up thus: the psychologist, as such, has no interest in the facts of "telepathy" except in so far as they throw light, as any facts about abnormal mental states may, on the known laws of normal mental processes. The "psychical researcher," on the other hand, thinks his facts sufficient warrant for postulating types of mental process of which normal life reveals nothing. Hence, unlike the psychologist, he approaches the facts in a non-scientific spirit. In a subsequent "Study of Involuntary Movements," conclusive experimental proof is given of the dependence of "thought-reading" performances upon unconscious movements of the muscles of the "subject" towards the object on which attention is directed. Of the remaining papers the most suggestive is perhaps that on "The Dreams of the Blind."